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Short communication

Does *siwonhan-mat* represent *delicious* in Korean foods?Dai Ja Jang^a, Ae Ja Lee^b, Soon-A Kang^c, Seung Min Lee^d, Dae Young Kwon^{a,*}^a Korea Food Research Institute, Songnam, South Korea^b Division of Food Service Industry, Baekseok Culture University, Cheonan, South Korea^c Department of Food and Nutrition, Hoseo University, Asan, South Korea^d Department of Food Service Management, Sejong University, Seoul, South Korea

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ABSTRACT

Background: Koreans believe that there is another sense experienced throughout the body when eating, in addition to smell and taste. This taste, *siwonhan-mat*, describes a sensation within the body, including the tongue, stomach, and intestines, when consuming food. *Siwonhan-mat* is often considered to be synonymous with deliciousness among Koreans. In this paper, determining factors of *siwonhan-mat* are explored in terms of *kan* (levels of salinity) and taste. Two representative dishes of *siwonhan-mat*, *kongnamul-kuk* (bean sprout soup) and *hwangtaebuko-kuk* (pollock soup), are used in this study. Sensory evaluation tests were performed in order to understand the relationship between *siwonhan-mat* and levels of salinity and taste.

Methods: Different versions of *kongnamul-kuk* and *hwangtaebuko-kuk* were created with either of two types of seasoning (salt or soy sauce) and varying levels of salinity (1%, 2%, 3%, and 4%). The temperature of the *kuk* was set to 80°C, and varieties of *kuk* were randomly assigned to participants. The first group of participants rated *siwonhan-mat* in the *kuk*. The participants were 30 individuals in their 40s and 50s, as it is presumed that this age group would be more familiar with *siwonhan-mat*. 9 pt hedonic scale was used in the experiment. Another group of 30 participants was composed of people in their 20s and 30s, who were assumed to be less familiar with *siwonhan-mat* as compared to the first group. This group also rated deliciousness of the *kuk* using a similar procedure.

Results: This research was conducted to allow better understanding of *siwonhan-mat*, a sensation of taste experienced by Koreans, in relation to levels of salinity and taste. The results suggest that types of seasoning and levels of salinity are determining factors of *siwonhan-mat*. For *kongnamul-kuk*, 2% salinity earned the highest score in both the salt and soy sauce seasoning conditions. As for *buko-kuk*, 3% salinity with soy sauce was preferred. Ratings of deliciousness were correlated with ratings of *siwonhan-mat*, suggesting that *siwonhan-mat* may be a core element of pleasant taste in *kuk* and *tang*.

Conclusion: Balancing *kan* is a determining factor of *siwonhan-mat* in Korean cuisine. Particularly, a strong association between *siwonhan-mat* and deliciousness was found in *kuk* and *tang*, suggesting the importance of *siwonhan-mat* in experiencing the best flavor in Korean food.

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1. Introduction

Color, smell, taste, and texture are frequently used to describe the characteristics of food. Countries promote ethnic foods in the global marketplace based on these features, along with sharing the traditions and authenticity of their food culture. For instance, the

quality of wine is generally judged by the smell and taste. The culture surrounding wine-tasting has played an important role in promoting wine in the global market. Similarly, smell and taste are key factors in enjoying food, and, in a more specific sense, ethnic foods. The western view of taste generally refers to sensations of the taste buds [1,2]. However, the East Asian view of taste adds to the five basic tastes (味) other senses of taste experienced throughout the body, such as spiciness [3,4]. In either case, taste is regarded as the most important feature of food.

In a previous paper [3], the authors analyzed *siwonhan-mat* from linguistic, literary, and scientific approaches in order to

* Corresponding author. Korea Food Research Institute, 62 Anyangpangkyo-ro 1201-bunkil, Songnam, Kyongki-do, 463-746, South Korea.

E-mail address: dykwon@kfri.re.kr (D.Y. Kwon).

understand and discuss the influence of *siwonhan-mat* in Korean cuisine. *Kuk* and *tang*, representative Korean dishes considered to possess *siwonhan-mat*, were also discussed in the context of Korean food culture, literature, and traditional cooking methods of Korean food. The meaning of *siwonhada* is related to the physical sense of openness experienced as a sensation of relief in the chest, stomach, circulatory system, and *qi* (氣). Cathartic emotions from stories are also described using *siwonhada*. Thus, the synonyms of *siwonhada* in this sense would be: pleasant, refreshing, and gratifying. Review of the linguistic origin of *siwonhada* has shown that the original usage of *siwonhada* was not related to a description of low temperature [3,5]. The English word *cool* is often translated as *siwonhada*, and it is assumed that this incorrect translation has contributed to the spread of misunderstanding [3]. In a western context, having cola and hamburgers is presumed to create a similar sensation as *siwonhan-mat*. As mentioned previously [3], *siwonhan-mat* is a refreshing taste that is associated with the sensation of food touching soft tissues in the mouth, swallowing food in the throat, and digesting food in the stomach.

The determining factors of *siwonhan-mat* and the importance of scientific research on those factors were also discussed in the previous paper [3]. Additionally, researchers need to take account of *neukihan-mat* [3] (roughly translated as *greasy*, *oily*, or *creamy*), the antonym of *siwonhan-mat*, when studying this phenomenon. It is presumed that *siwonhan-mat* is composed of several elements beyond the five basic tastes, including temperature, salinity, acidity, spiciness, texture, and feelings of refreshment. More research on the determining elements of *siwonhan-mat* should be undertaken to allow further understanding of this sensation.

Siwonhan-mat is often experienced by consuming *kuk*, such as *haejang-kuk*, *kongnamul-kuk*, *hwangtae-kuk*, and *kimchi-kuk* [3]. *Kuk* [6] is a staple of the Korean diet, along with *bap* (rice), and the most representative type of Korean food that contains *siwonhan-mat*. In an attempt to demonstrate the determining factors of *siwonhan-mat*, *kongnamul-kuk* [3,7], and *hwangtaebuko-kuk* (similar to *hwangtaekonganmul-kuk* without soybean sprouts) [3] will be analyzed in terms of *kan*¹ [3,8]. Moreover, the relationship between *siwonhan-mat* and deliciousness in two traditional Korean *kuk* will be reviewed.

2. Materials and methods

Different versions of *kongnamul-kuk* and *hwangtaebuko-kuk* were created with two types of seasoning (either salt or soy sauce) and varying levels of salinity. These variables were modified to elicit understanding of their relationship to *siwonhan-mat*.

2.1. Materials

Kongnamul-kuk was created using the process for *jeonju-kongnamul-kuk* [7] with *jwinuni-kongnamul* from Jeonju, Korea. *Buko-kuk* was created based on a recipe for Kangwon *hwangtaebuko-kuk* using dried pollock (*hwangtae*) produced in Kangwon-do, Korea. Natural sea salt from Sinan and traditionally made soy sauce from Sunchang were used for seasoning [9].

2.2. Recipes for *kongnamul-kuk* and *buko-kuk*

Although *kongnamul-kuk* and *buko-kuk* have been regarded as representative types of *kuk* containing *siwonhan-mat*, no standard recipes have been established. Below are the simplified recipes used in the experiment.

- *Kongnamul-kuk*: First, bean sprouts (*kongnamul*) were washed three times in running water; 200 g of bean sprouts were cooked in 1 L of water. Once the water reached a high boil, the heat was reduced to medium and it was left to boil for 10 minutes. The *kuk* was seasoned with salt and soy sauce separately. Four different levels of salinity were created: 1%, 2%, 3%, and 4%.
- *Buko-kuk*: Thinly sliced, air-dried pollock (100 g) were pan-fried, then cooked in 1 L of pollock broth over high heat. Once the water boiled, the heat was reduced to medium and it was left to boil for 10 minutes. The *kuk* was also seasoned with salt or soy sauce to the same four levels of salinity: 1%, 2%, 3%, and 4% (Fig. 1).

The levels of salinity used in the experiment were selected in the pre-experimental stage and each level of salinity was tested using a salimeter (HM Digital, Seoul, Korea).

2.3. Evaluation of *siwonhan-mat*

A pre-experimental survey showed that people experience *siwonhan-mat* when the temperature of the *kuk* was 80°C. Therefore, the temperature of both *kongnamul-kuk* and *hwangtaebuko-kuk* was set to 80°C. The experiment was composed of two conditions to study the relationship between *siwonhan-mat*, levels of salinity, and deliciousness. In the first condition, the participants were 30 food specialists in their 40s and 50s. All participants had prior experience with sensory evaluation tests. Information on the goals of the experiments and key elements of *siwonhan-mat* were provided to the participants prior to the sensory evaluation test. Each version of *kuk* was labeled with a number selected from a table of randomly generated digits, which was provided to participants along with a spoon. In the evaluation process for *siwonhan-mat*, a Likert scale from 1 to 9 was used, 1 representing the lowest degree of *siwonhan-mat*, and 9 the highest.

In the second condition, 30 participants in their 20s and 30s, who, it was assumed, had less familiarity with *siwonhan-mat*, were selected. No information on *siwonhan-mat* was given to the participants prior to the test. The participants were instructed to evaluate the taste of the *kuk*. The rest of the experimental variables were the same.

The collected data were analyzed using SPSS 12.0, using ANOVA and Duncan's multiple range tests at $p < 0.05$.

3. Results and discussion

3.1. Ratings of *siwonhan-mat* for *kongnamul-kuk* and *hwangtaebuko-kuk*

Koreans enjoy various types of *kuk*, such as *malkeunjang-kuk*, *gom-kuk*, *seolreong-tang*, *galbi-tang*, *haejang-kuk*, *miyeok-kuk*, *chueo-tang*, *tteok-kuk*, *mandu-kuk*, *yukgaejang*, *buko-kuk*, and *kimchi-kuk*. In this experiment, two popular types of *haejang-kuk* (an iconic hangover dish in Korea), *kongnamul-kuk* and *hwangtaebuko-kuk*, were used to reveal the relationship between *siwonhan-mat* and levels of salinity. The sensory evaluation test was taken by food specialists who are familiar with *siwonhan-mat*. As for the *kongnamul-kuk* (Table 1) seasoned with salt, 2% salinity received the highest rating of 7.43, followed by 1% with 5.93, then 3%, and

¹ *Kan* is the balance of the salt concentration to enhance the taste of food [7]. The most common seasoning in Korean cuisine is soy sauce, but salt and soybean paste are also widely used.

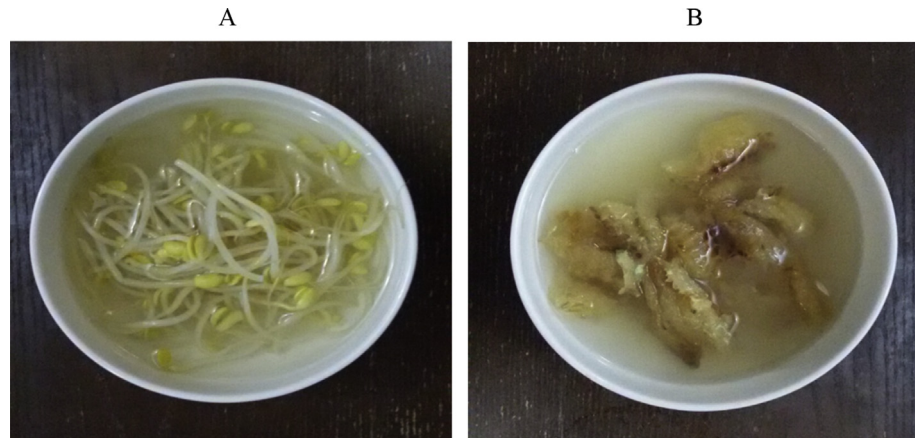


Fig. 1. (A) Kongnamul-kuk and (B) hwangtaebuko-kuk. In order to make kongnamul-kuk, bean sprouts were washed three times in running water. First, 200 g of bean sprouts were cooked in 1 L of water. Once the water reached a high boil, the heat was reduced to medium and it was left to boil for 10 minutes. The kuk was seasoned with salt and soy sauce separately. Thinly sliced air-dried pollock were used for buko-kuk. First, 100 g of dried pollock were pan-fried, then cooked in 1 L of pollock broth over high heat. Once the water boiled, the heat was reduced to medium and it was left to boil for 10 minutes. The kuk was also seasoned with salt and soy sauce separately.

Table 1
Preference of siwonhan-mat for kongnamul-kuk and buko-kuk.

	Seasoning materials	Rating of siwonhan-mat			
		1% salinity	2% salinity	3% salinity	4% salinity
Kongnamul-kuk	Salt	5.93 ± 2.20 ^c	7.43 ± 1.57 ^d	4.03 ± 1.38 ^b	2.10 ± 0.92 ^a
	Soy sauce	3.73 ± 1.57 ^b	6.87 ± 2.21 ^d	5.33 ± 2.07 ^c	2.63 ± 1.61 ^a
Buko-kuk	Salt	5.63 ± 1.75 ^c	6.70 ± 1.82 ^d	3.97 ± 1.35 ^b	2.17 ± 0.75 ^a
	Soy sauce	4.70 ± 1.74 ^b	5.87 ± 1.89 ^c	7.03 ± 1.59 ^d	2.03 ± 0.81 ^a

9 pt hedonic scale was used to evaluate siwonhan-mat, with 1 representing the lowest and 9 the highest. All data are expressed as mean ± standard deviations for triplicate experiments ($n = 30$). ^{a-d} In a row means significantly different at 5% significance level by Duncan's multiple range test ($p < 0.05$).

finally 4%. Likewise, for the kongnamul-kuk seasoned with soy sauce, 2% salinity received the highest rating, 6.87, followed by 3%, with 5.33. Participants indicated that they could not experience siwonhan-mat at 1% and 4% salinity. These results demonstrate that 2% salinity was the most suitable for creating siwonhan-mat in both the salt and soy sauce seasoning conditions. Overall, seasoning with salt resulted in higher scores compared to soy sauce.

The data collected with buko-kuk showed similar results to those of kongnamul-kuk (Table 1). The buko-kuk seasoned with salt at 2% salinity was ranked the highest, with a score of 6.70, followed by 1%, with 5.63. At 4% salinity, participants did not experience siwonhan-mat. As for buko-kuk seasoned with soy sauce, 3% salinity scored 7.03, followed by 2%, with 5.87. While salt is the preferred seasoning to create siwonhan-mat in kongnamul-kuk, the buko-kuk seasoned with soy sauce at 3% salinity was rated the highest overall.

3.2. Rating of deliciousness for kongnamul-kuk and hwangtaebuko-kuk

Exploring the link between siwonhan-mat and deliciousness is a meaningful direction for future research on Korean food. In this experiment, kongnamul-kuk and hwangtaebuko-kuk were used to find the association between siwonhan-mat and taste. Participants in their 20s and 30s were selected for the sensory evaluation test as it is assumed that they were less familiar with siwonhan-mat than the older comparison group. According to the ratings of taste for kongnamul-kuk seasoned with salt (Table 2), 2% salinity received the highest score, 7.63, followed by 1%, with 5.90. Three percent and 4% salinity did not receive ratings. Similarly, for the kongnamul-kuk seasoned with soy sauce, 2% salinity earned the highest score, 7.13,

Table 2
Preference of deliciousness for kongnamul-kuk and buko-kuk.

	Seasoning materials	Rating of deliciousness			
		1% salinity	2% salinity	3% salinity	4% salinity
Kongnamul-kuk	Salt	5.90 ± 2.07 ^c	7.60 ± 1.25 ^d	4.80 ± 1.45 ^b	1.93 ± 0.74 ^a
	Soy sauce	4.43 ± 1.72 ^b	7.13 ± 1.87 ^d	6.03 ± 1.69 ^c	1.87 ± 0.90 ^a
Buko-kuk	Salt	6.07 ± 1.48 ^c	7.07 ± 1.20 ^d	3.33 ± 0.71 ^b	1.63 ± 0.67 ^a
	Soy sauce	4.27 ± 1.51 ^b	5.77 ± 1.70 ^c	7.23 ± 1.48 ^d	1.73 ± 0.74 ^a

9 pt hedonic scale was used to evaluate deliciousness, with 1 representing the lowest and 9 the highest. All data are expressed as mean ± standard deviations for triplicate experiments ($n = 30$). ^{a-d} In a row means significantly different at 5% significance level by Duncan's multiple range test ($p < 0.05$).

followed by 3%. At 1% and 4% salinity, participants reported the kongnamul-kuk as less delicious, and feedback indicated that this was due to lack of seasoning. These results were consistent with the data presented in the first condition. The ratings of taste for hwangtaebuko-kuk demonstrated comparable outcomes to kongnamul-kuk. For the hwangtaebuko-kuk seasoned with salt, 2% salinity had the highest score whereas, for the hwangtaebuko-kuk seasoned with soy sauce, 3% salinity was preferred.

These findings suggest that there is a correlation between siwonhan-mat and level of salinity, and siwonhan-mat and deliciousness.

Traditionally, kan [3,7] has been regarded as a key element to enhance the taste of food; without proper kan food would not be considered delicious. Although there have been various claims with respect to the origin of kan, no theories have been fully supported by evidence².

Particularly, kan plays an exclusive role in kuk and tang. As demonstrated in the experiment, kan is closely related to the experience of siwonhan-mat. Furthermore, the findings also suggest that siwonhan-mat is associated with perceived deliciousness of food.

This paper is a first attempt to examine siwonhan-mat in terms of kan within scientific research. Further research is needed to

² Some people suggest that the origin of kan is the Korean word '간', which means liver. Others have claimed that kan originated from the Chinese character '間', which means the middle. However, none of these claims has been supported with scientific evidence. It is also possible that kan is an original Korean word, given its long history of use by Koreans.

uncover the determining factors of unique tastes experienced by Koreans in relation to temperature, acidity, salinity, and the five basic tastes. This research will play an important role in helping others learn about, understand, and enjoy Korean food.

Japan has claimed that umami should replace spiciness within the five basic East Asian tastes [4] and should be equated with pleasing taste. However, in Korea, *siwonhan-mat* rather than umami is most closely associated with delicious taste. Also, at present, sweetness is often equated with deliciousness, due to the current trend of using considerable amounts of sugar in food. However, in traditional Korean recipes, simple and plain tastes such as *siwonhan-mat* were preferred and considered delicious. Further research on tastes experienced with Korean foods is needed in order to improve the exposure of traditional Korean food in the global market.

Siwonhan-mat is often used as an expression of deliciousness in Korean food. Generally, *siwonhan-mat* can be experienced when having *kuk*. Koreans consume various types of *kuk*, including *malkeunjang-kuk*, *gom-kuk*, *seolreong-tang*, *galbi-tang*, *haejang-kuk*, *miyeok-kuk*, *chueo-tang*, *tteok-kuk*, *mandu-kuk*, *yuk-gaejang*, *buko-kuk*, and *kimchi-kuk*. *Haejang-kuk* is famously known to relieve hangovers and is made of broth boiled with bean sprouts, dried pollock, and *kimchi*. In this paper, two popular types of *haejang-kuk*, *kongnamul-kuk* and *hwangtaebuko-kuk*, were used to reveal the relationship between *siwonhan-mat* and levels of salinity. The correlations calculated in this experiment were statistically significant and demonstrate that the determining factor of *siwonhan-mat* is the level of salinity. Moreover, the sensory evaluation test for taste showed strong associations between *siwonhan-mat* and deliciousness. These findings suggest

that *siwonhan-mat* is a core element of deliciousness in Korean food, specifically for *kuk* and *tang*.

Conflicts of interest

The authors have no conflicts of interest.

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